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MISSISSIPPI TIMBER STANDS BEFORE AND AFTER CUTTING

Lee M. James and William P. Hoffman

A REPORT OF THE SOUTHERN FOREST SURVEY
William A. Duerr, In Charge

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Chas. A. Connaughton, Director
New Orleans, La.

THE SOUTHERN FOREST SURVEY

The Southern Forest Survey, an activity of the Southern Forest Experiment Station, covers the seven States of the Station's territory--Alabama, Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas. This Survey is a part of the nation-wide Forest Survey authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold purpose is (1) to take inventory of the supply of standing timber and other forest products; (2) to ascertain the rate at which this supply is being increased through growth; (3) to determine the rate at which this supply is being diminished through industrial and local use, and by fire, insects, disease, and other agencies; (4) to estimate the present requirements and the probable future trend in the requirements for timber and other forest products; and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies may be formulated for the effective use of lands suitable for forest production.

MISSISSIPPI TIMBER STANDS BEFORE AND AFTER CUTTING

Lee M. James and William P. Hoffman[1/]
Southern Forest Experiment Station

A recent publication of the Southern Forest Survey shows that in the past 14 years Mississippi's forest resource has continued to decline.[2/] Because of the general preference of wood users for pine and the aggressiveness of hardwood in many areas, some 2 million acres of pine stands have been converted into hardwood and hardwood-pine stands. Total softwood growing stock has dropped 20 percent in volume, with the heaviest losses occurring in the larger tree sizes. Hardwood growing stock has held its own in total; but the drain has been in the more valuable species and sizes of trees, while compensating growth has been in the less desirable species and sizes. Hardwood volume in sawlog trees has been cut back 20 percent in the 14 years.

Much of the explanation for these sharp changes in the forest resource can be found in prevailing logging practices--in the kind of stands selected for logging, the kind of trees cut, and the effect of cutting on the character of the timber. These aspects of logging practice in Mississippi were investigated in 1947 in a survey of cutting operations. Findings of the survey are summarized in this report.[3/]

How Stands Look Before Cutting

In stands selected for logging, well over half of all the pine timber and 40 percent of the hardwood is in trees smaller than 14 inches in diameter at breast height (d.b.h.).[4/] More

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1/ Field data used in this report were collected by R. D. Carpenter, W. H. Crowell, Beryl Jones, and E. G. Sullivan, under the supervision of W. S. Stover.

2/ Southern Forest Experiment Station. Forest Statistics for Mississippi. South. Forest Expt. Sta. Forest Survey Release 59. (Processed.) 1949.

3/ A description of the field survey, an estimage of sampling errors, and definitions of terms are given beginning on page 17.

4/ Only growing stock is considered in this report. Except where sawlog growing stock is specified, the reference is to total cubic-foot growing stock.

than one-third of the sawlog volume in these stands is in grade 3 material. Nevertheless, poor as these areas are in tree size and quality, they are better than the average of all forests in the State. 2/

Stands selected for logging vary widely with the type of product. Pine sawlogs are taken from stands having, on the average, some 60 percent of their total pine volume in trees above 12 inches d.b.h. Pine pulpwood, in contrast, is taken from stands with only 13 percent of the pine growing stock in sizes above 12 inches. Hardwood products contrast with each other even more strongly than pine products both in size of trees and tree quality in stands selected for cutting.

What Trees Make Up The Cut

Because of the limitations of the stands available for cutting, a very large proportion of the cut comes from small and low-grade trees. Of the volume logged, more than half of the pine and one-fourth of the hardwood comes from trees under 14 inches in diameter. Roughly one-fourth of the hardwood sawlog cut and one-half of the pine sawlog cut is grade 3 trees. (In this report, hardwood tree grade is based on the grade of the butt log alone. See the definitions on page 19.)

The sizes and grades of trees cut vary a great deal from product to product. In pines, nearly half the volume of sawlogs and half the volume of hewn ties is from 14- to 18-inch trees, but virtually all the pulpwood and 90 percent of the fuel wood is cut from trees 12 inches d.b.h. or smaller. In hardwoods, the contrasts in tree sizes logged for different products are even greater.

Hardwood trees logged are usually much larger than pine trees cut for corresponding products. However, in the case of hewn ties, the same tree sizes are cut in both pines and hardwoods; and at small sawmills, hardwood sawlogs are not much larger than pine sawlogs.

So far as quality is concerned, about two-thirds of the hardwood saw timber cut for veneer logs and one-half of that cut for sawlogs is in grade 1 trees, but only one-fourth of the saw timber cut for cooperage bolts is grade 1. In pine, quality independent of size seems to have little effect on the choice of trees for cutting.

5/ As of 1946-48, the Southern Forest Survey found that some 60 percent of Mississippi's softwood growing stock (largely pine) and 50 percent of the hardwood was in trees under 14 inches d.b.h. Sixty-six percent of Mississippi's hardwood sawlog volume was in grade 3 logs, and 62 percent of the pine sawlog volume was in grade 3 trees.

How Stands Look After Cutting

Stands are usually cut heavily, particularly for the larger and better-quality trees. On the average, cutting of sawlogs in pine stands takes nearly all trees over 12 inches in diameter and almost three-fourths of the volume in 10- and 12-inch trees. (Small sawmills cut more heavily in the latter sizes than large sawmills.)

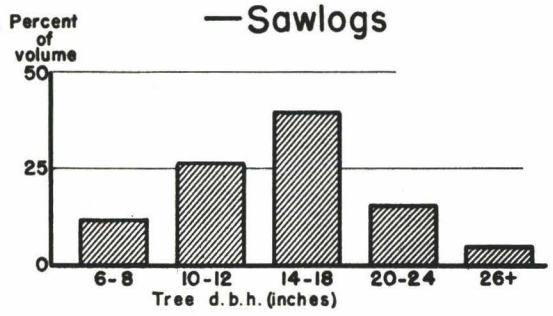
Pulpwood cutting takes a heavier toll--three-fourths of the pine volume in 6- and 8-inch trees is removed in the average operation. Larger trees are cut less heavily for pulpwood because they are hard to handle and because owners want to save such trees for sawlog cuts. Cutting for hewn ties and fuel wood does not appear to be as heavy as cutting for sawlogs and pulpwood, but it is likely to be repeated more frequently. Moreover, the timber which survives these operations will probably be cut subsequently for sawlogs.

In regard to volume removed, hardwood cutting is not so severe as pine cutting. This holds for all products except fuel wood, which takes a much greater proportion of hardwood than of pine, and is true for cutting by small sawmills as well as cutting by large sawmills.

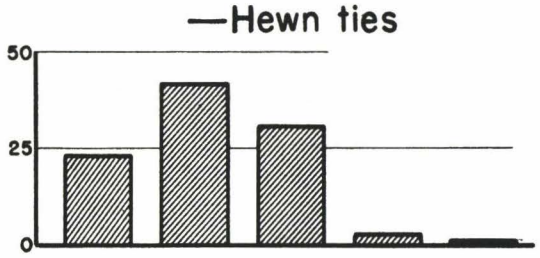
The superficially more favorable picture for hardwood logging is not so cheering when tree grade and species selection are considered. Regardless of the product they are interested in, most hardwood operators concentrate their cutting in the better tree grades. On the average, virtually all grade 1 trees are cut; 68 to 77 percent of the volume of grade 2 is cut; but only 41 to 46 percent of the volume of grade 3 is cut (except that in grades 2 and 3 small sawmills generally cut more heavily, and larger sawmills cut less heavily than these percentages indicate). This means that for each hardwood product cut, regardless of size, the saw-timber volume left standing is principally grade 3. Such cutting can only result in continuous downgrading of stands.

The process of hardwood downgrading is accentuated by species selection. Thus, although the average sawlog cutting removes only 50 percent of the hardwood growing stock, the cutting is concentrated among higher-value species. Species such as white oak, cherrybark oak, and yellow-poplar are cut twice as heavily as are lesser-value species like hickory and black gum.

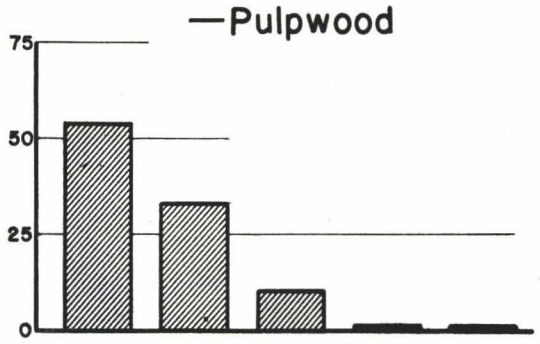
How Pine Stands Look Before Cutting For —
(Cubic-foot growing stock, by tree diameter)



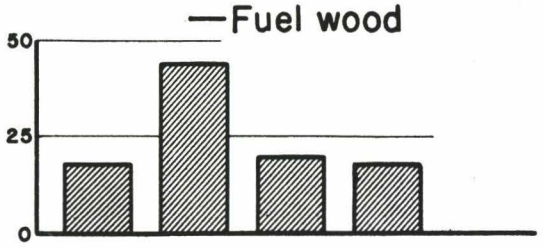
Pine stands with the largest trees are usually chosen for sawlog operations. However, even these stands have few big trees. Scarcely a fifth of the growing-stock volume is in trees 20 inches and larger.



Stands with somewhat smaller trees are logged for hewn ties. Only four percent of the volume of pine growing stock is in trees 20 inches and larger.

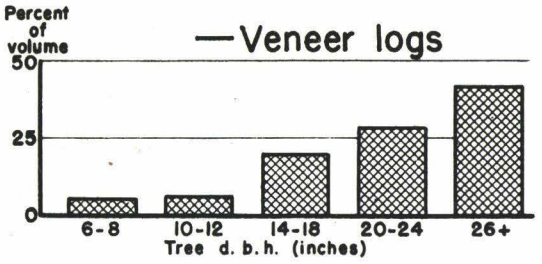


Pulpwood cutting is done in the smallest stands, where, on the average, more than half of the volume is in 6- and 8-inch trees.

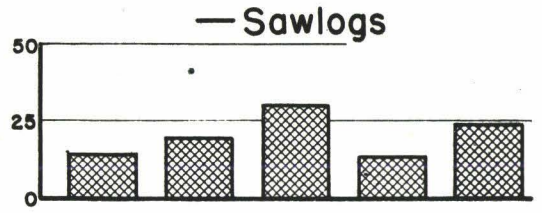


Fuel wood is cut from trees of any size — whatever is available locally.

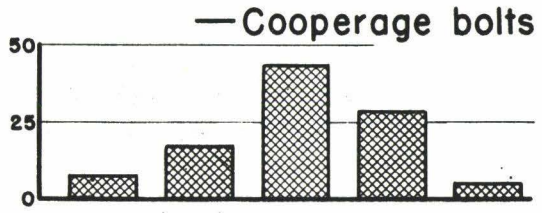
How Hardwood Stands Look Before Cutting For—
(Cubic-foot growing stock, by tree diameter)



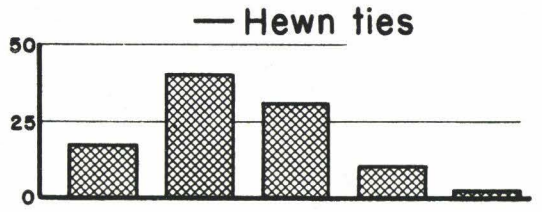
Veneer logs are usually taken from stands with the largest hardwood trees.



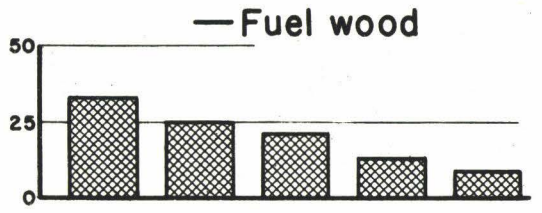
Sawlogs are cut in hardwood stands with more than one-third of the growing stock volume in trees 20 inches and larger.



Similar stands are logged for cooperage bolts, except that there are fewer of the very large trees.



Hewn ties are removed from smaller hardwood stands, in which most of the growing stock volume is in trees less than 14 inches in diameter.

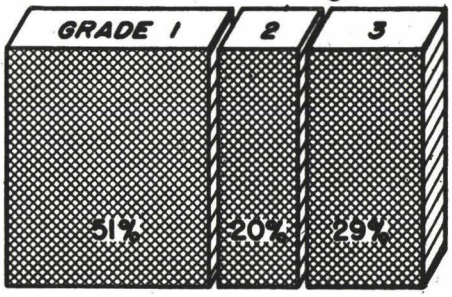


Fuel wood is cut from stands with trees of all sizes, but one-third of the volume of growing stock is in 6- and 8-inch trees alone.

How Hardwood Stands Look Before Cutting For—

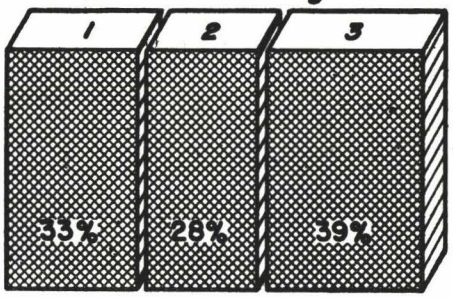
(Sawlog growing stock, by tree grade)

—Veneer logs



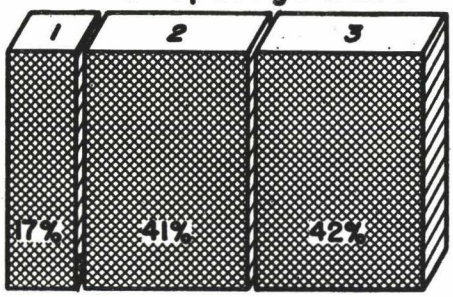
The highest-quality hardwood stands are usually selected for veneer-log operations.

—Sawlogs



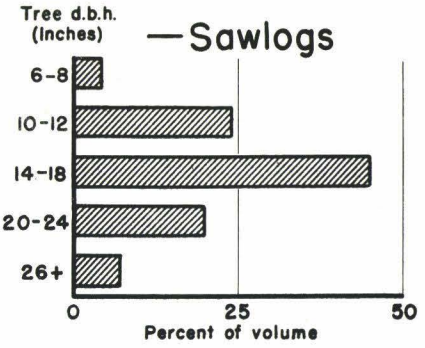
The typical sawlog operation occurs in stands with roughly equal volumes in tree grades 1, 2, and 3.

—Cooperage bolts

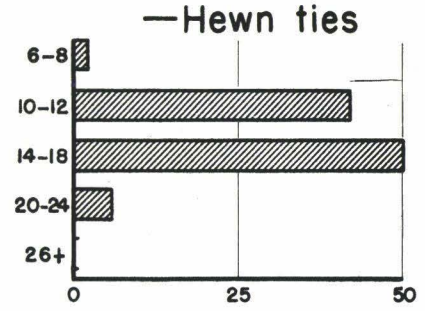


Cooperage bolts are taken from hardwood stands averaging only 17 percent of their sawlog volume in grade 1 trees.

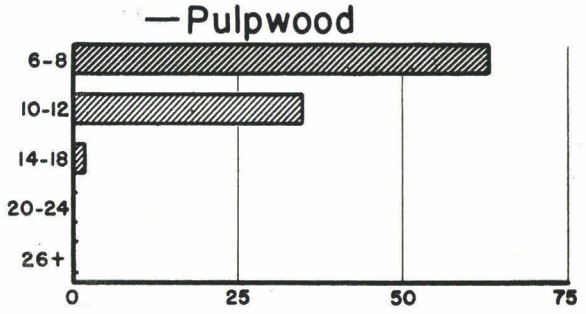
What Pine Trees Make Up The Cut For—
(Cubic-foot growing stock cut, by tree diameter)



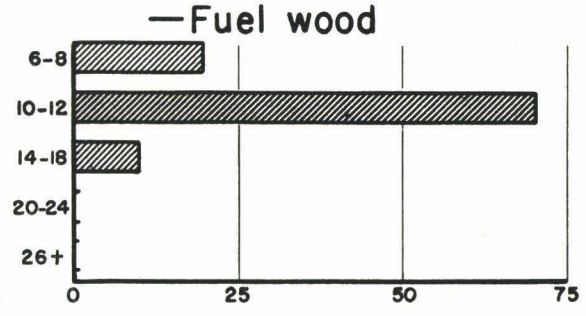
Nearly half of the pine growing-stock volume cut for sawlogs is in trees 14 to 18 inches d.b.h. Only a small portion is in sizes below 10 inches or above 24 inches.



Hewn ties are cut from pine trees similar to those felled for sawlogs, except that few trees above 18 inches are used.

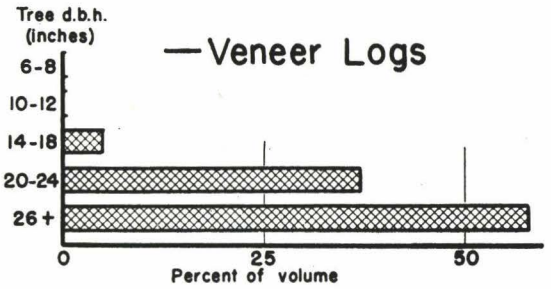


Pulpwood is usually taken from very small pine trees.

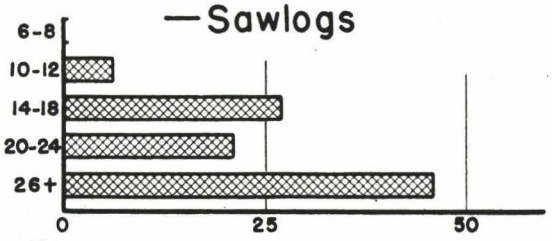


Fuel wood cutting is confined to small trees, but not as small as those cut for pulpwood.

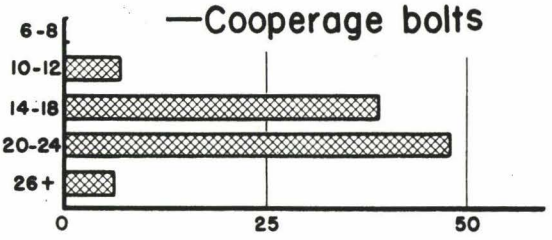
What Hardwood Trees Make Up The Cut For —
(Cubic-foot growing stock cut, by tree diameter)



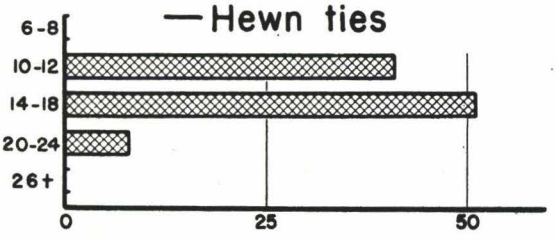
Veneer logs are usually cut from the biggest hardwood trees.



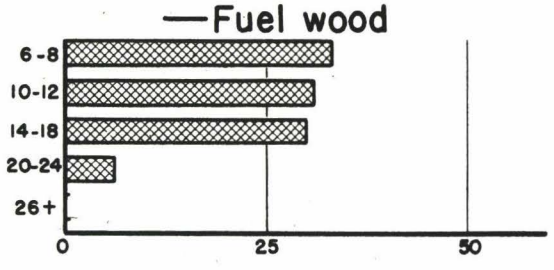
Most hardwood sawlogs are also taken from the larger trees. Some two-thirds of the sawlog harvest is in trees 20 inches d. b. h. and larger.



Nearly 90 percent of the hardwood growing-stock volume cut for cooperage bolts is in trees ranging from 14 to 24 inches in diameter.



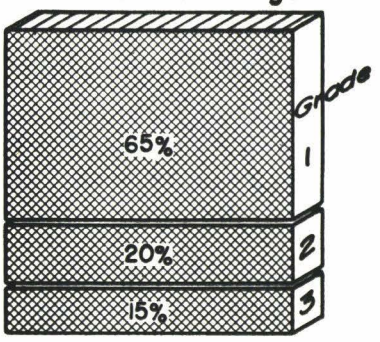
Hewn ties are cut from the same size trees in hardwoods as in pine.



Hardwood fuel wood is cut chiefly from small trees.

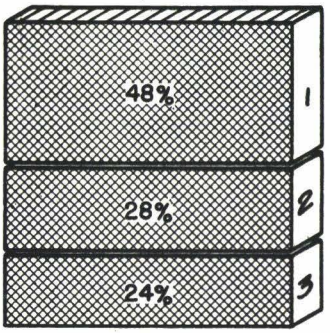
What Hardwood Trees Make Up The Cut For—
(Sawlog growing stock cut, by tree grade)

— Veneer logs



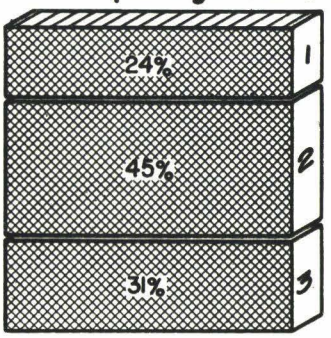
Virtually two-thirds of the volume cut for veneer logs is in grade 1 trees.

— Sawlogs



Hardwood trees cut for sawlogs are not consistenty as good quality as those cut for veneer logs. Not all timber operators are in a competitive position to get the best quality trees.

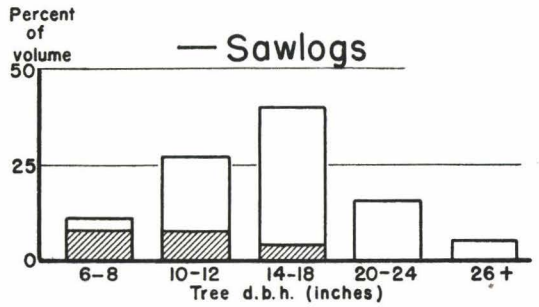
— Cooperage bolts



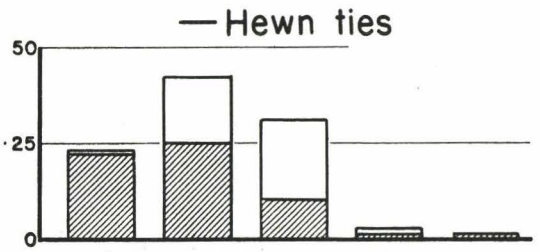
Only one-fourth of the sawlog volume cut for cooperage bolts is in grade 1 trees.

How Pine Stands Look After Cutting For —

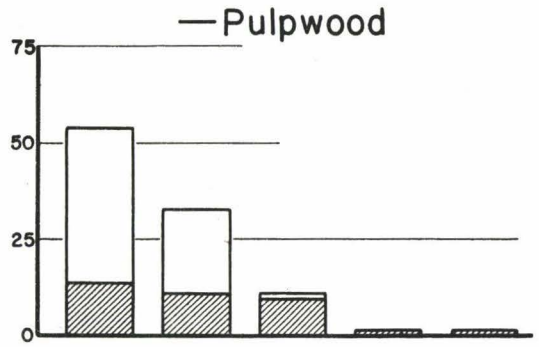
(Cubic-foot growing stock by tree diameter, and proportion cut and left)



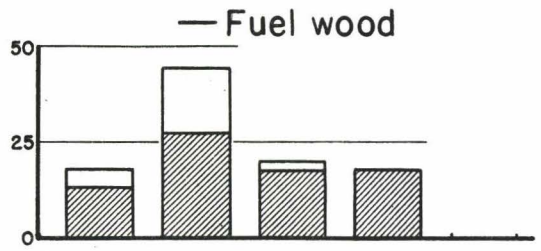
Sawlog cutting in pine stands takes almost all trees over 12 inches d.b.h. and nearly three-fourths of the volume in 10-and 12-inch trees. Even in 6-and 8-inch trees, one-fourth of the volume is cut. Of all the volume in growing-stock trees, only 22 percent is left standing after cutting.



Pine stands are cut more lightly for hewn ties, but the same stands are likely to be cut again soon for the same product or, for sawlogs or pulpwood.



Pulpwood logging is most severe; it takes three-fourths of the volume of 6-and 8-inch trees. Cutting is apparently lighter in larger tree sizes because more trees are earmarked for sawlog cutting and because of pulpwood-logging limitations.

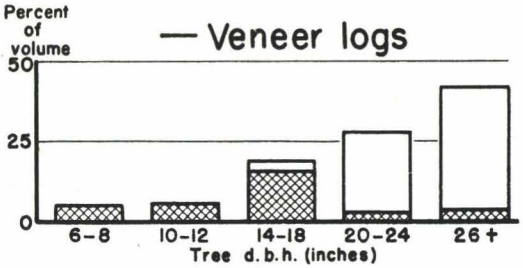


In volume, at least, fuel wood cutting in pine stands is lighter than logging for other products.

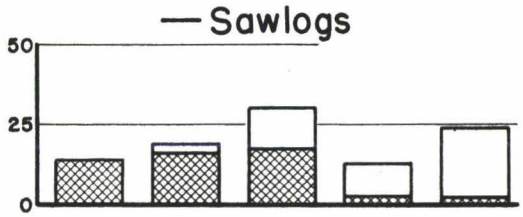
How Hardwood Stands Look After Cutting For ——

(Cubic-foot growing stock by tree diameter, and proportion cut and left)

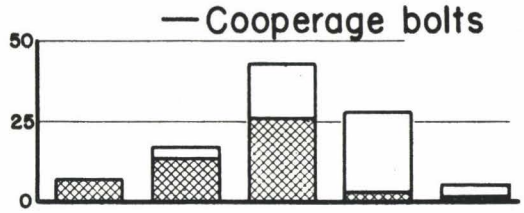
Cut Left



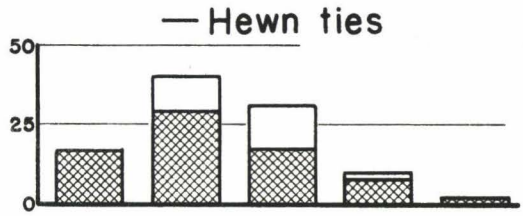
In hardwood stands cut for veneer logs, nearly all trees above 18 inches d.b.h., but few of the smaller trees, are taken. The residual trees contain only one-third as much volume as the growing stock before cutting.



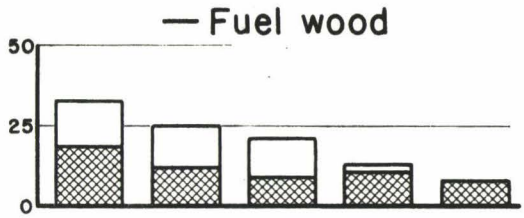
Logging for sawlogs is also heavy in trees above 18 inches and relatively light in smaller tree sizes.



The impact of logging for cooperage bolts is similar to that of sawlog cutting.



Logging for hewn ties is not heavy, but as in pine stands cut for the same product, the stands are likely to be cut again soon for hewn ties or for some other product.



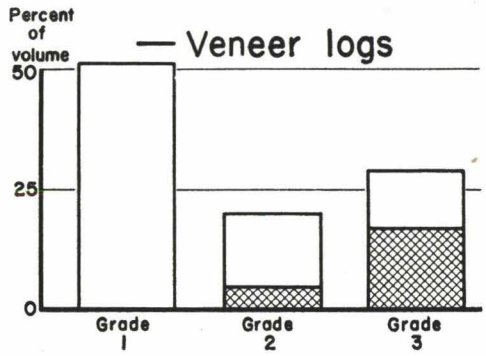
Fuel wood is one hardwood product cut heavily in small tree sizes. Fuel wood cutting takes more than 40 percent of the volume of 6- and 8-inch trees and 50 percent of the volume of 10- and 12-inch trees.

How Hardwood Stands Look After Cutting For —

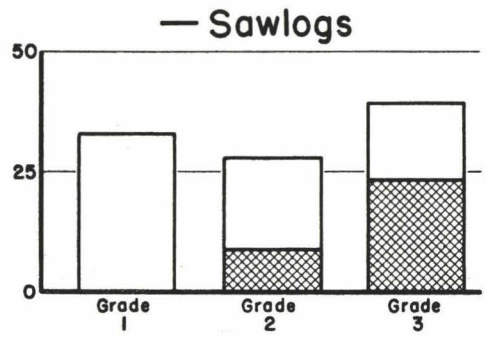
(Sawlog growing stock by tree grade, and proportion cut and left)

Cut

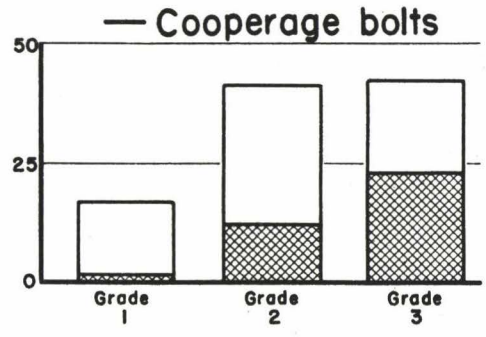
Left



In hardwood stands cut for veneer logs, all grade 1 trees are cut, but 23 percent of the sawlog volume in grade 2 trees and 59 percent of the sawlog volume in grade 3 trees is left standing. Only 21 percent of the sawlog growing stock is uncut, and most of this is grade 3.



Logging for sawlogs has a similar impact on hardwood tree grades. Some of the grade 3 trees left will grow into grade 2 trees, but many more will never improve in grade. Such logging can only lead to continuous down-grading of stands.

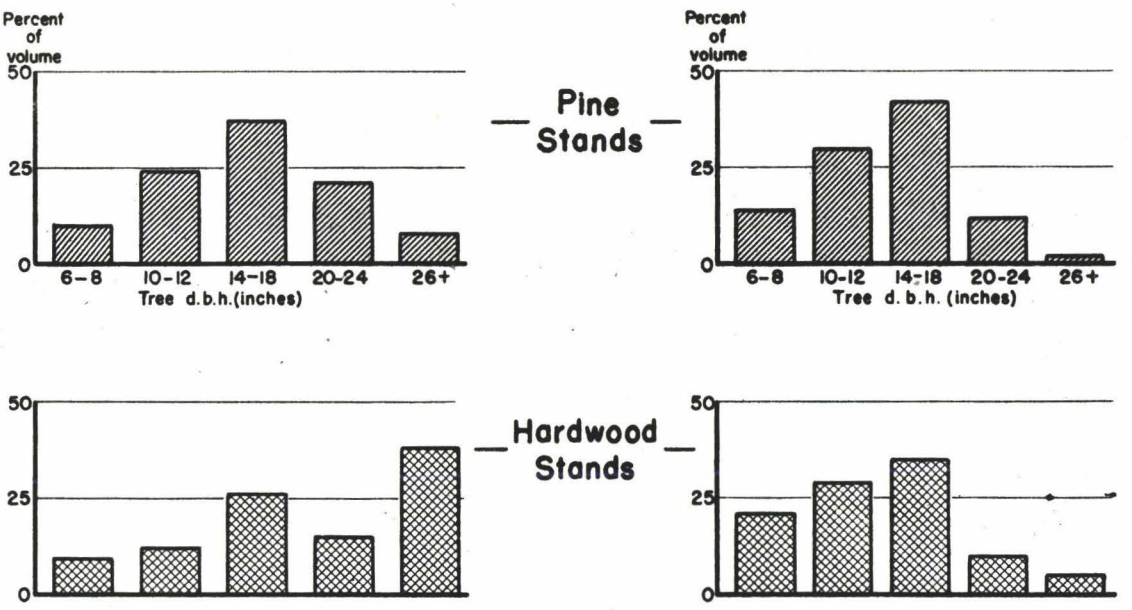


The same conclusions apply to logging for cooperage bolts.

How Stands Look Before Cutting For —

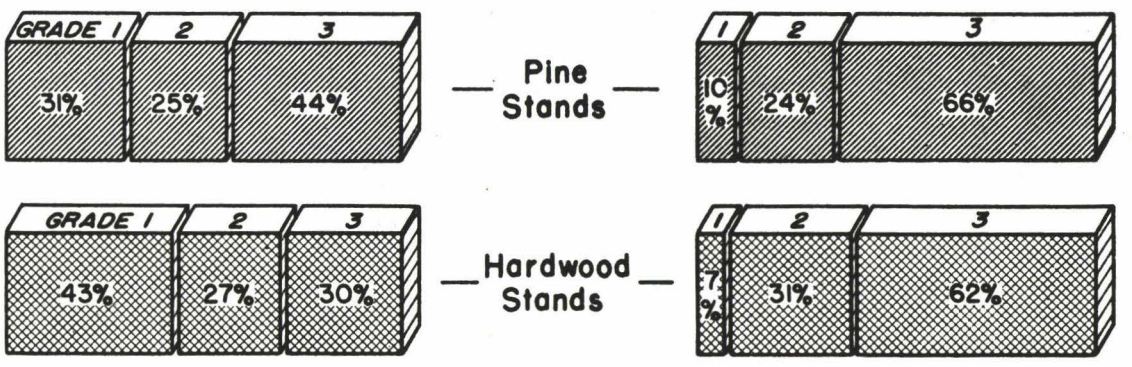
Large Sawmills — versus Small Sawmills —

(Cubic-foot growing stock, by tree diameter)



Large mills have access to pine trees slightly larger on the average than those available to small mills; and in hardwood operations, the contrast between large and small sawmills is much sharper. Nearly 40 percent of the hardwood growing stock in stands selected for large mills is in tree sizes above 24 inches d.b.h.; only 5 percent of the hardwood volume in stands selected for small mills is in these same tree sizes.

(Sawlog growing stock, by tree grade)

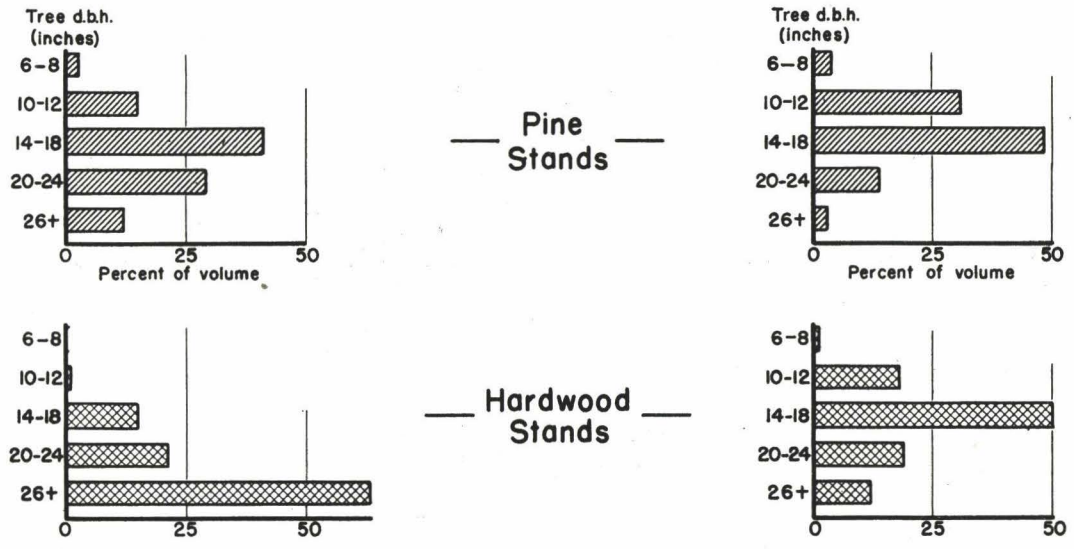


Before cutting, the quality of both pine and hardwood sawlog growing stock is much better in stands logged for large mills than for small mills.

What Trees Make Up The Cut For—

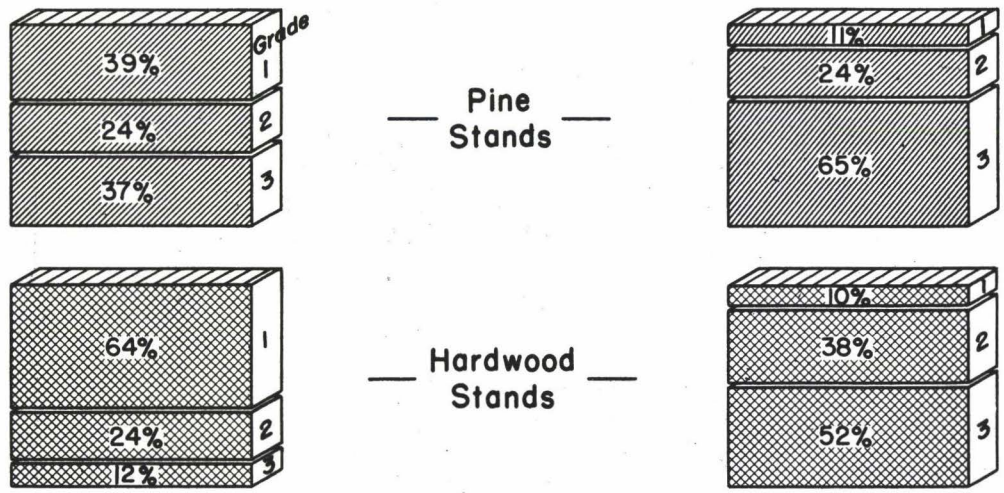
Large Sawmills— versus Small Sawmills—

(Cubic-foot growing stock cut, by tree diameter)



Pine timber cut for large sawmills averages somewhat bigger than that cut for small sawmills. In hardwood cutting, however, differences are more pronounced. Large mills get the bulk of their hardwood volume in trees above 24 inches d.b.h. Small mills get half their volume in trees 14 to 18 inches d.b.h. and only 12 percent in trees larger than 24 inches.

(Sawlog growing stock cut, by tree grade)

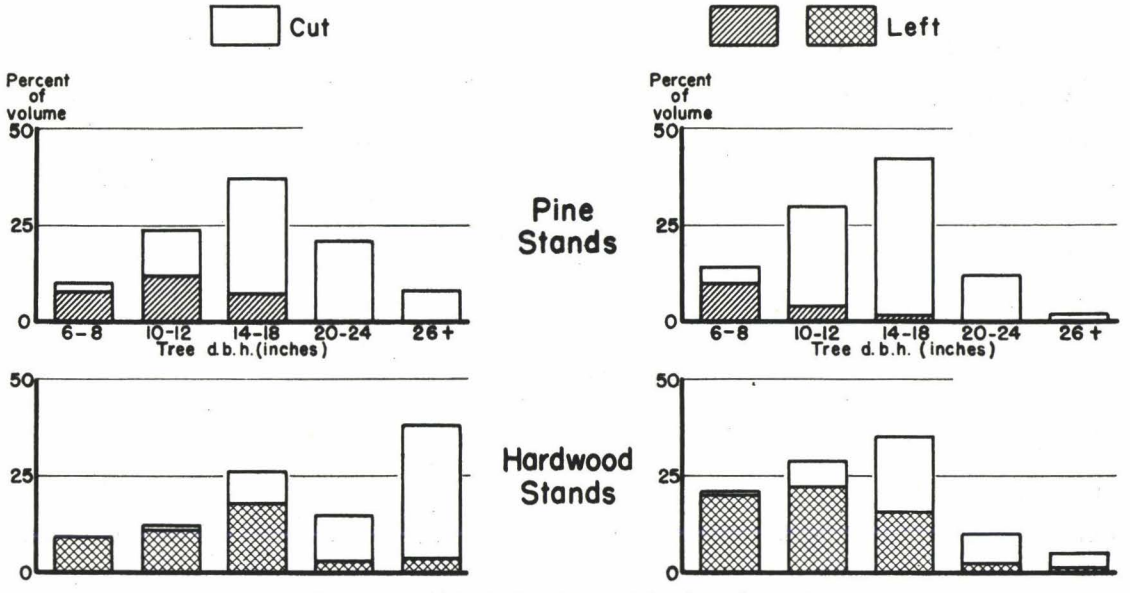


The quality of sawlog growing stock cut for large sawmills is much better than that cut for small sawmills, particularly in hardwood stands.

How Stands Look After Cutting For —

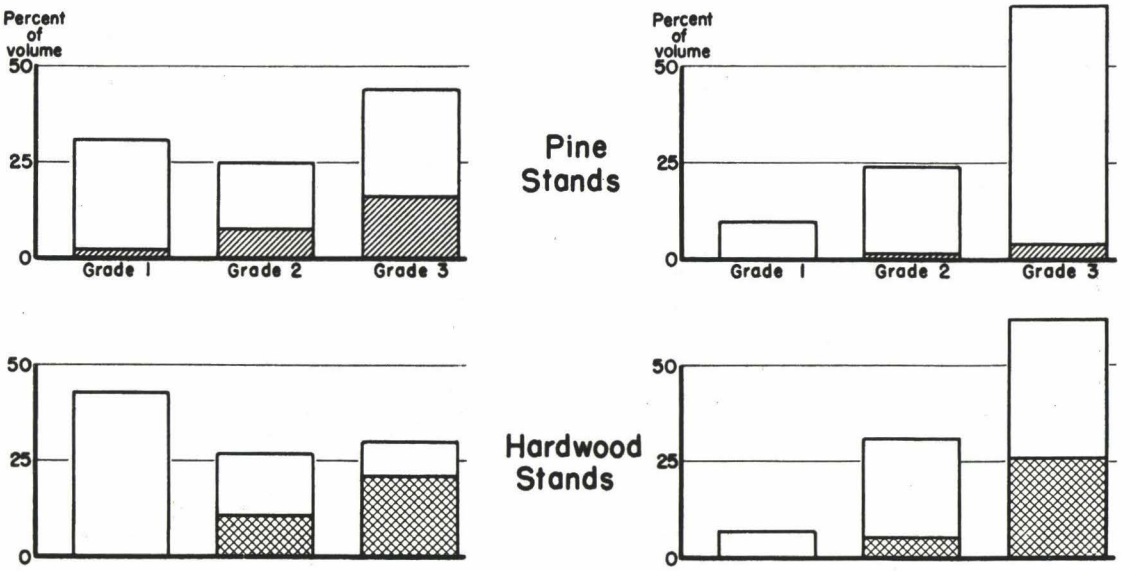
Large Sawmills — versus Small Sawmills —

(Cubic-foot growing stock by tree diameter, and proportion cut and left)



In tree sizes below 20 inches d.b.h., both pine and hardwood stands are cut much more heavily for small sawmills than for large sawmills. In bigger trees, the severity of cut is about the same.

(Sawlog growing stock by tree grade, and proportion cut and left)

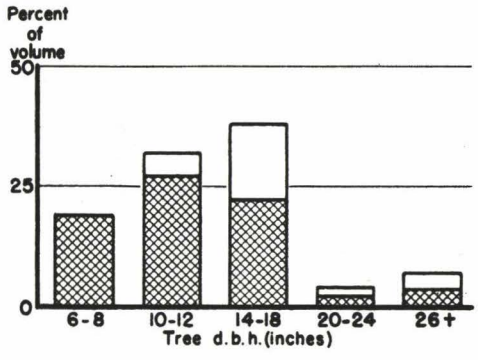


Pine tree grade has little effect on cutting for small mills, since virtually all sawlogs are cut regardless of grade. In pine cutting for large mills, some pine sawlog growing stock is left, chiefly in the lower grades. In hardwood stands, logging removes all grade 1 trees. Of the volume in grades 2 and 3, however, a considerably larger proportion is left after cutting for large mills than for small mills.

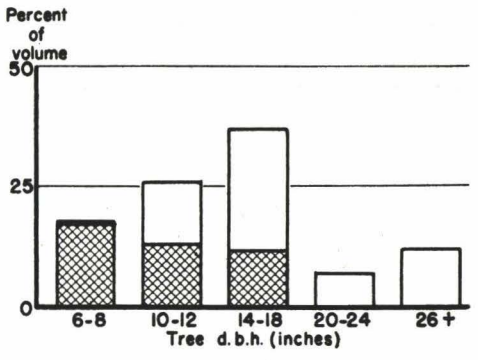
How Hardwood Stands Look After Sawlog Cutting—

(Cubic-foot growing stock by tree diameter, and proportion cut and left)

—Low-value Species (hickory and black gum as examples)

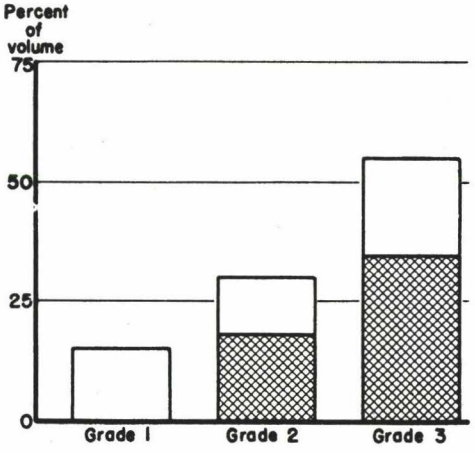


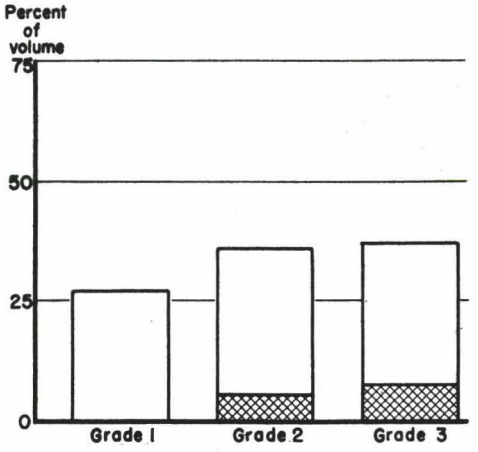
—High-value Species (yellow-poplar and white and cherrybark oaks as examples)



In all tree sizes, high-value species are generally cut much more severely for sawlogs than are typically low-value species.

(Sawlog growing stock by tree grade, and proportion cut and left)





Grade 1 trees tend to be cut regardless of species, but in grades 2 and 3 the high-value species are cut much more heavily than the low-value species. More of the low-value species are left in the residual stands.

The Field Survey and Its Accuracy

This report is based on measurements of 104 quarter-acre sample plots taken in 1947 on logging operations throughout the State of Mississippi. The plots were selected by products roughly in proportion to 1946 drain. Fence posts, poles, piling, and miscellaneous products were omitted from the study, but these products accounted for only 8 percent of the drain. Their omission permitted stronger sampling of other minor products.

Product	Timber drain, 1946 (Percent)
Lumber	51
Pulpwood	15
Fuel wood	15
Hewn ties	5
Veneer	3
Cooperage	3
Poles and piling	2
Fence posts	1
Miscellaneous	5
Total	100

The location of sample plots was controlled to insure geographical coverage of each product in proportion to drain, but within each locality plots were chosen at random. With few exceptions, plots were taken on going operations so that products could be measured and their volume assigned to the particular trees from which they were cut. Products were sampled separately--i.e., cutting on any one plot was for one timber product only.

Cutting on each plot was usually either of pine or of hardwood species. Pine and hardwood species were cut together on one-tenth of the plots, but in all these instances the volume of hardwoods removed was far less than that of pine. This indicates that in mixed stands, cutting emphasizes pine; hardwoods are cut only occasionally in such stands, and in a highly selective fashion.

Sampling proved to be adequate for most of the statistical compilations sought. Where inadequate, data were combined into larger classes, and in several of the charts, minor products were omitted. These are the standard errors of estimate for statistics in a typical chart:

Diameter breast high (inches)	Estimate of pine volume cut for small sawmills	Standard error of estimate
	Percent	
6 - 8	4	± 2
10 - 12	31	± 6
14 - 18	48	± 6
20 - 24	14	± 6
26 and up	3	± 3

Following are the highest standard errors for any chart in the report:

Diameter breast high (inches)	Estimate of hardwood volume cut for veneer logs	Standard error of estimate
	Percent	
14 - 18	5	± 4
20 - 24	37	±10
26 and up	58	±15

Definition of Terms

Class of Timber

Growing stock. Sawlog growing stock is the sawlog portion of sawlog trees. Total growing stock includes sawlog growing stock, upper stems of pine sawlog trees, and entire stems of cordwood trees to a minimum diameter of 4 inches inside bark.

Sawlog tree. A live, merchantable pine 9.0 inches or larger in d.b.h., or a live, merchantable hardwood 11.0 inches or larger in d.b.h. To be merchantable, the tree must have at least a merchantable 12-foot butt log or 50 percent of its gross volume in merchantable logs.

Cordwood tree. A live tree 5.0 inches or larger in d.b.h., but smaller than sawlog size, which would become a sawlog tree if it should grow to sawlog size.

Volume

Board-foot (sawlog) volume. Net volume in merchantable sawlogs in sawlog trees, measured in board feet by the International 1/4-inch log rule (sawlog growing stock).

Cubic-foot volume. Net volume of total growing stock, measured in cubic feet (cubic-foot growing stock).

Diameter

D.b.h. (diameter breast high). Tree diameter in inches, outside bark, measured at 4½ feet above ground.

Diameter class. Each 2-inch diameter class includes diameters 1.0 inch below and 0.9 inch above the stated midpoint. E.g., the 12-inch class includes trees 11.0 inches through 12.9 inches.

Size of Sawmill

Large sawmill. A sawmill producing at least 3 million board feet of lumber annually.

Small sawmill. A sawmill producing less than 3 million board feet of lumber annually

Tree Grade

Pine:

Grade 1 (smooth trees). Not less than 20 feet of clear bole and at least 40 percent of the merchantable length clear of limbs and knots in sections not less than 8 feet in length.

Grade 2 (limby trees). Not less than 12 feet of clear bole and 25 to 39 percent of the merchantable length clear of limbs and knots in sections not less than 8 feet in length.

Grade 3 (rough trees). Merchantable trees below grade 2 specifications.

Hardwood: 6/ (Tree grade is same as grade of butt log)

Grade 1. Smooth, generally clear logs which yield at least one-half of their volume in higher grades of lumber.

Grade 2. Logs of average clearness which yield from one-third to one-half of their volume in higher grades of lumber.

Grade 3. Small logs or logs of less than average clearness which yield less than one-third of their volume in higher grades of lumber; or sound, straight logs with many small defects which make them suitable only for ties and timbers.

6/ For detailed external specifications of log grades used, see "Interim Sawlog Grades for Southern Hardwoods." Southern Forest Experiment Station, 9pp. (Processed.) 1948, rev.